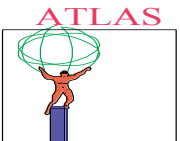


Maintenance and Operations TRT mechanics and Electronics

**Harold Ogren
Indiana University**

DOE/NSF Review of U.S. ATLAS
Fermilab April 9-11, 2002



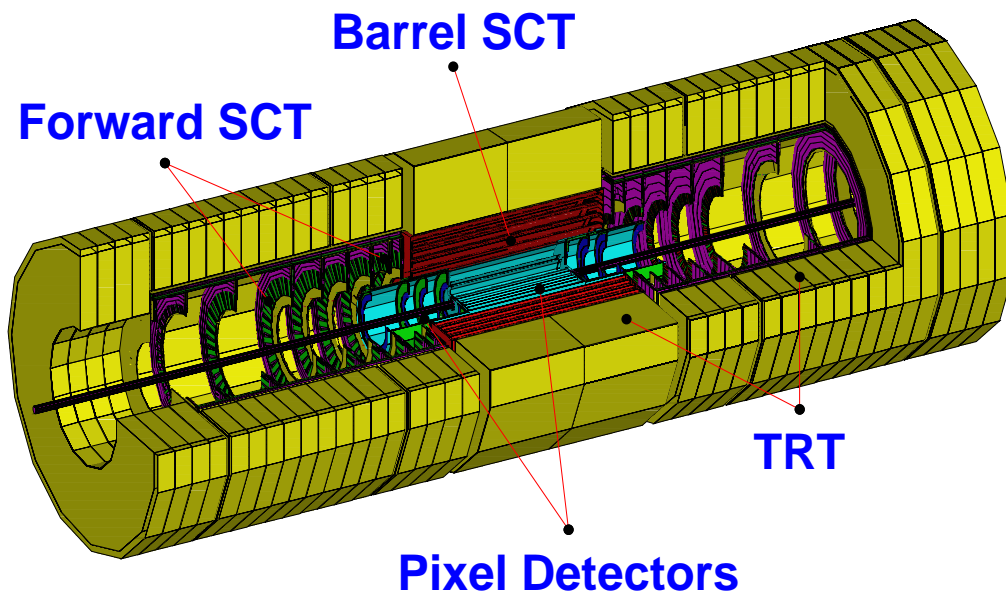
ATLAS BARREL TRT

WBS 1.2.1 Module Construction

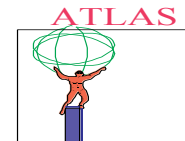
Duke University
Indiana University
Hampton University

WBS 1.2.5 Front-end Electronics

University of
Pennsylvania



DOE/NSF Review of U.S. ATLAS
Fermilab April 9-11, 2002



TRT Barrel Modules

Duke, Hampton, Indiana

- **Module Assembly Responsibilities**

- ◆ Design, Assembly of all TRT Barrel modules
- ◆ Gain testing all barrel modules
- ◆ Design of a large fraction of services (cables, piping, etc) within TRT volume
- ◆ Design assembly of Spaceframe

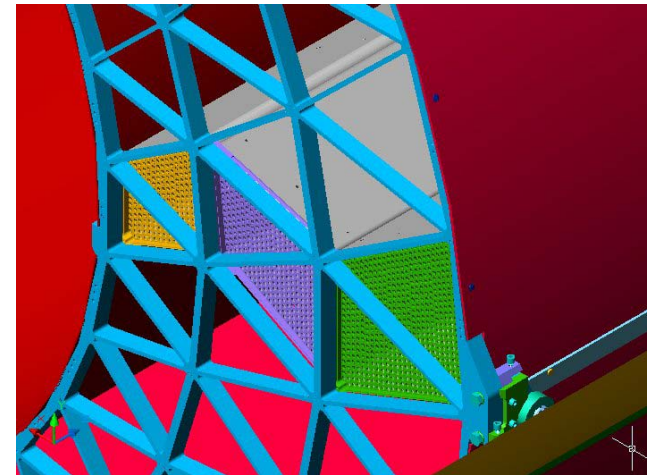
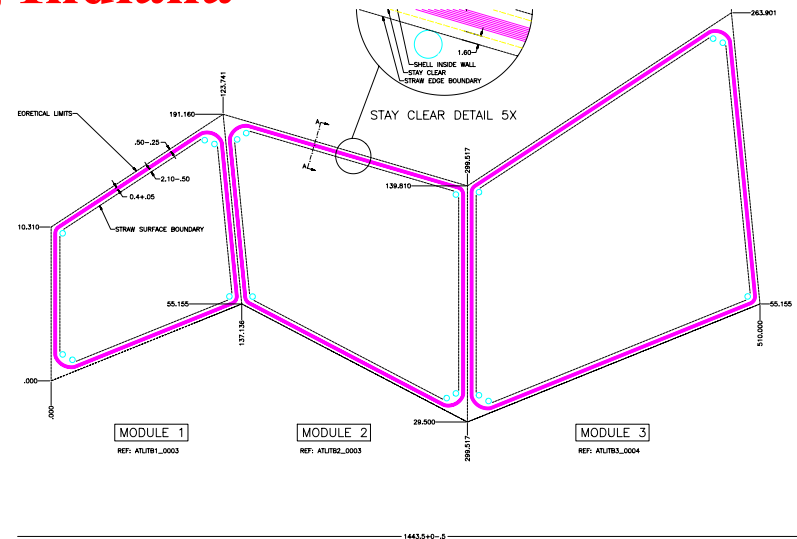
- **Installation**

- ◆ Assist in assembly and alignment Spaceframe
- ◆ Installation- work in Bldg 154-SR
 - ▲ Checkout of all modules at CERN prior to installation in spaceframe

- **Pre-Operations**

- ▲ Barrel checkout after installation in space frame
- ▲ Checkout of barrel services, electrical, cooling.
- ▲ Maintain Barrel for ID in pit.

- **M&O operations and maintenance, Run time, common expenses, spares**

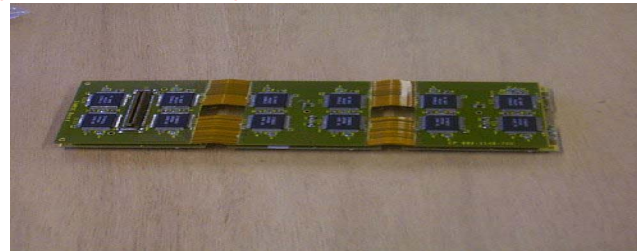


Front end Electronics

University of Pennsylvania

- **Electronics Responsibilities**

- ◆ Production of ASDBLRs
- ◆ Design of DTMROC's
- ◆ System management and engineering of electronics and cabling
- ◆ Construction of electronics front-boards



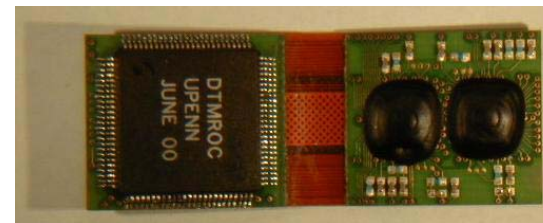
192-channel
DTMROC Flex
board

64-channel
ASDBLR board

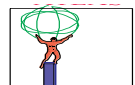
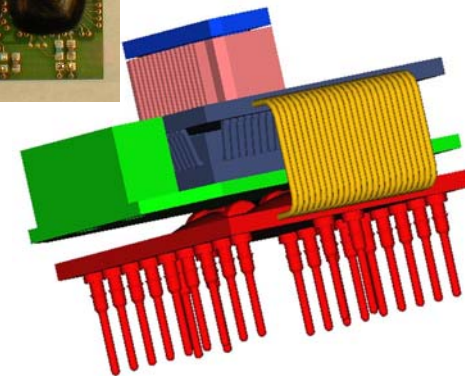


- **Primary M&O responsibilities**

- ◆ Engineering(grounding, shielding, etc) ... preoperations & commissioning and initial operations.
- ◆ Electronics maintenance after assembly into the spaceframe and after installation in the detector.
- ◆ General contribution (physicists and technical personnel) to preops, commissioning, operations and maintenance.



Flex card - Barrel



Barrel TRT Assembly Schedule

ID	Task Name	Duration	Start	Finish	2002				2003				2004				2005	
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2
4	test modules	393 days	Tue 6/18/02	Thu 12/18/03														
5	modules at CERN	391 days	Wed 8/28/02	Wed 2/25/04														
6	Bldg 154 checks	393 days	Wed 8/28/02	Fri 2/27/04														
7	spaceframe assembly	44 days	Tue 2/18/03	Fri 4/18/03														
8	install barrel modules	306 days	Mon 4/21/03	Mon 6/21/04														
9	Barrel ready for SCT	0 days	Mon 6/21/04	Mon 6/21/04														
10	ID barrel ready for installation	0 days	Tue 2/15/05	Tue 2/15/05														



TRT Barrel Pre-operations

Module begin arriving at CERN in Sept-02.

Final modules arrive at the end of 2003.

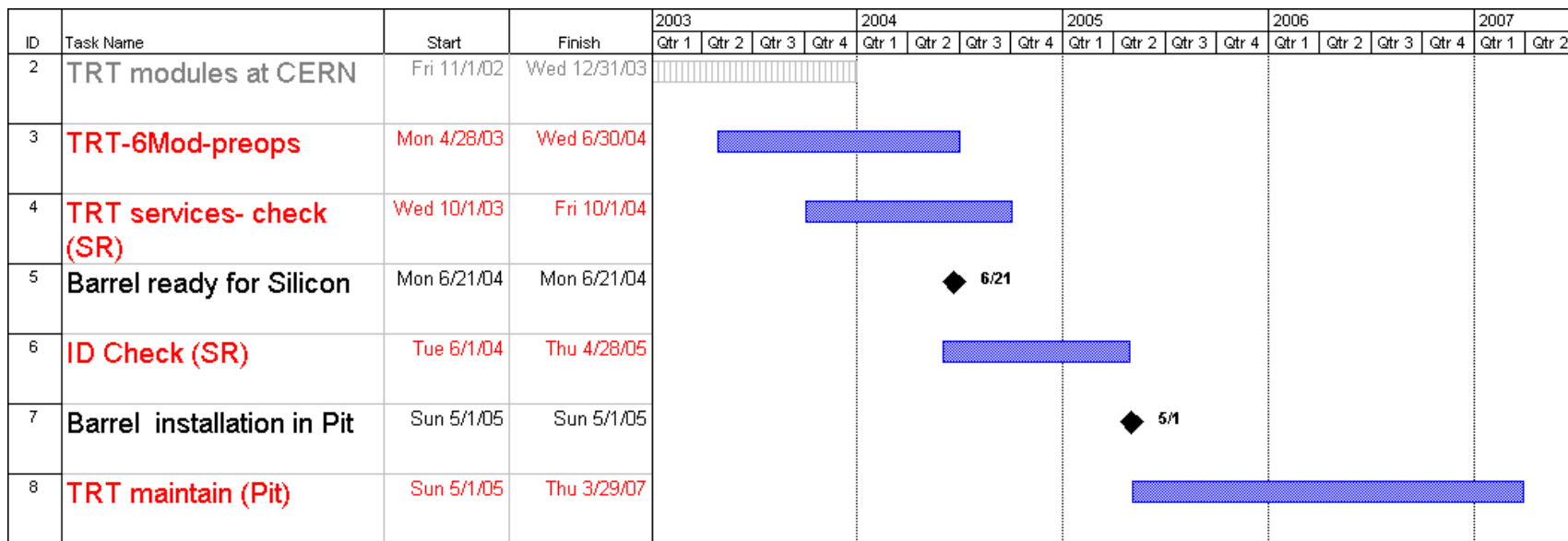
First modules are installed in the spaceframe in SR Bldg in April-03.

Pre-operations on modules after installation into the spaceframe in SR Bldg.

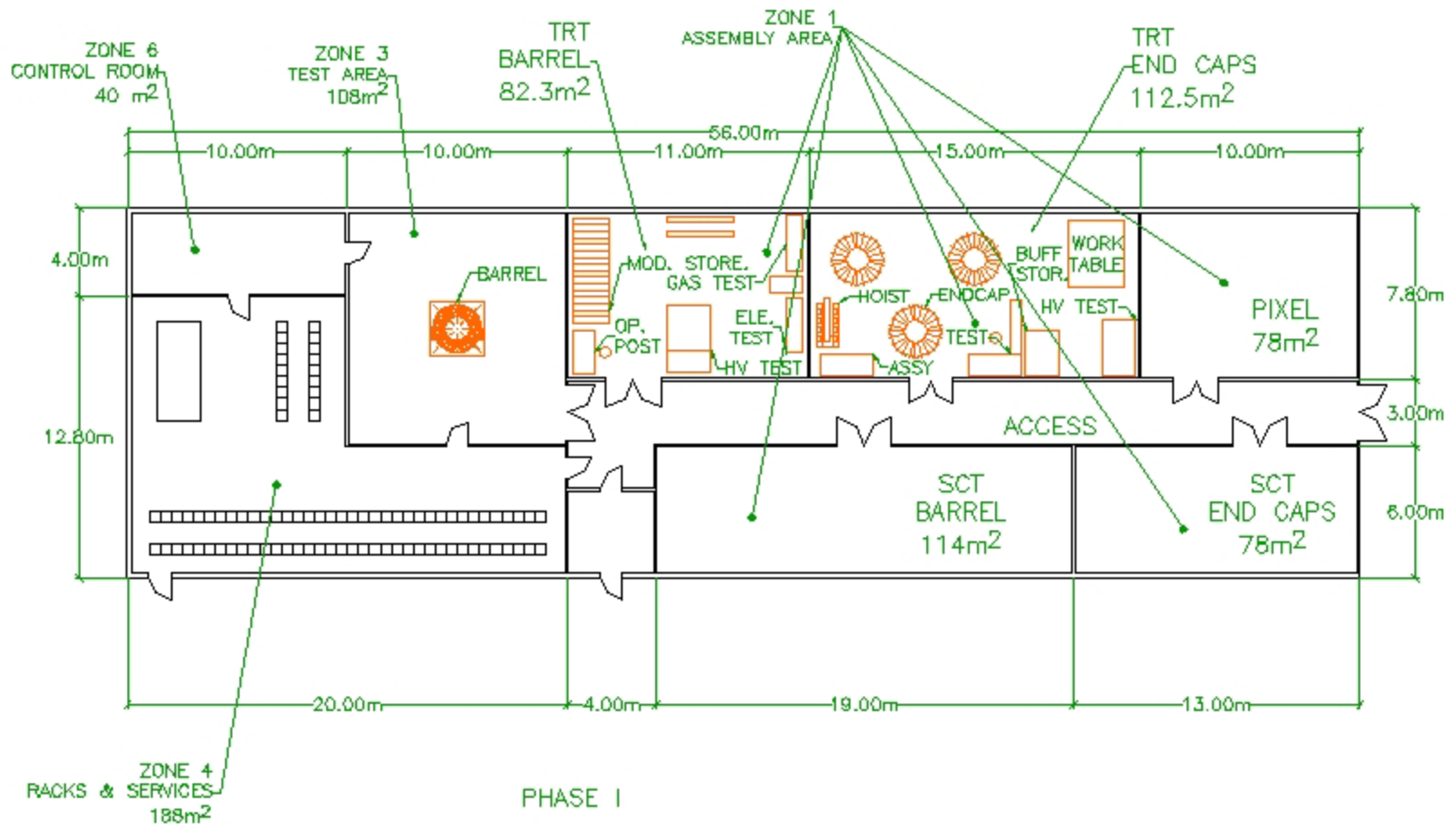
- ◆ **For module preoperations three technicians required in FY03 through FY04. In FY05-FY07 one full-time technical staff person (in addition to the base personnel) is needed to work with CERN personnel to maintain the barrel and end cap systems. Mechanical Engineer required for FY04.**
- ◆ **For electronics one technician, one electrical Engineer, and one computing professional are needed for overall electronics testing and systems engineering during pre-operations.**



Pre –operations Schedule



SR building- Barrel assembly



MANPOWER ESTIMATE SUMMARY IN FTEs

WBSNo: 3.2

Funding Type: Base+Infrastructure

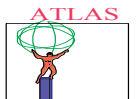
3/17/2002 9:27:02 PM

Description: TRT

Institutions: All

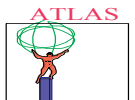
Funding Source : All

	<i>FY03</i>	<i>FY04</i>	<i>FY05</i>	<i>FY06</i>	<i>FY07</i>	<i>FY08</i>	<i>FY09</i>	<i>FY10</i>	<i>FY11</i>	<i>FY12</i>	<i>Calcu- lated Total</i>	<i>Entered</i>
Faculty	.5	4.0	5.5	5.5	.5	.5	.5	.5	.5	.5	18.5	.0
Sr Research	3.0	3.0	3.0	3.0	1.5	1.5	1.5	1.5	1.5	1.5	21.0	.0
Term Scientist											.0	.0
Post Doc	4.5	4.5	4.0	4.0	2.5	2.5	2.5	2.5	2.5	2.5	32.0	.0
Grad Student	.0	2.0	5.0	5.5	4.0	4.0	4.0	4.0	4.0	4.0	36.5	.0
Mechanical Engineer											.0	.0
Electrical Engineer											.0	.0
Technical											.0	.0
Computer	.5		1.0	1.0							2.5	.0
Designer											.0	.0
Adminsitrator											.0	.0
Contract Labor											.0	.0
TOTAL LABOR	8.5	13.5	18.5	19.0	8.5	8.5	8.5	8.5	8.5	8.5	110.6	.0



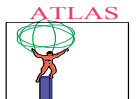
TRT Barrel WBS 3.2 Level 5

WBS		FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12	Total
Number	Description	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)
3.2	TRT	534	1267	695	402	319	374	382	401	340	356	5070
3.2.1	TRT-Subsystem specific	491	1223	657	335	188	201	201	201	185	201	3884
3.2.1.1	TRT Pre-operations	329	1223	657	296	0	0	0	0	0	0	2505
3.2.1.1.4	TRT-6 mod-grps (5/03 - 7/04)	329	853	0	0	0	0	0	0	0	0	1183
3.2.1.1.5	TRT Services (10/03 - 10/04)	0	299	95	0	0	0	0	0	0	0	394
3.2.1.1.7	IDcheckout(6/04 -5/05)	0	70	494	0	0	0	0	0	0	0	564
3.2.1.1.8	ID Integration(5/05-4/07)	0	0	68	296	0	0	0	0	0	0	364
3.2.1.2	Operations	0	0	0	0	164	0	0	0	0	0	164
3.2.1.2.1	Runtime activities	0	0	0	0	164	0	0	0	0	0	164
3.2.1.3	TRT Maintenance	161	0	0	40	24	201	201	201	185	201	1215
3.2.1.3.1	Shutdown maintenance	0	0	0	40	24	201	201	201	185	201	1054
3.2.1.3.2	spares	161	0	0	0	0	0	0	0	0	0	161
3.2.2	Common TRT/ID	43	44	38	67	130	173	181	200	155	155	1186
3.2.2.1	Pre-Operations	43	44	38	67	0	0	0	0	0	0	192
3.2.2.2	maintenance and operations	0	0	0	0	130	173	181	200	155	155	994



Common Inner Detector M&O

- In addition to the specific M&O for TRT module assembly and Front-end electronics, there is a contribution to the general Inner Detector(ID) M&O.
- This has two major components:(1) support of maintenance equipment for the surface assembly(SR) building and (2) contributions of a share of the CERN-provided contract labor for M&O tasks.
- Our M&O estimates for the general ID M&O(3.1.4) are derived from the estimates made by the ID project leader, using 7% as a guideline. US-TRT is ~20% of the TRT program.

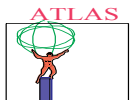


TRT Barrel Common

Funding Source:
Institutions All

AllFunding Type:Program

WBS		FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12
Number	Description	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)	(k\$)
3.2.2	Common TRT/ID	43	44	38	67	130	173	181	200	155	155
3.2.2.1	Pre-Operations	43	44	38	67	0	0	0	0	0	0
3.2.2.2	maintenance and operations	0	0	0	0	130	173	181	200	155	155



Conclusions-M&O

- **Installation costs are dominated by personnel.**
Our Highest priority is US technical experts:
 - ◆ Supervisor/tech IU – (½ FY03, FY04)
 - ◆ Supervisor/tech Duke- (½ FY03, FY04)
- **We have assumed that the base budgets at Duke(DOE), Hampton(NSF) and Indiana (DOE) will fill in with Faculty, staff scientists, postdoctoral students and graduate students.**
- **We have included spare module costs in M&O for the labor (Hampton, Duke and Indiana) associated with the production of spare modules and electronics cards.**
- **Operations and maintenance personnel costs for FY05 and onward are estimates of the US maintenance staff requirements.**
- **General CERN expenses are based on ID and TRT projections.**

